Report 10427
March 1996
REV.A

GENCORP
AEROJET

Integrated AMSU-A
Earth Observing System (EOS)
Advanced Microwave Sounding Unit-A (AMSU-A)
Command List Description

Contract No: NAS 5-32314
CDRL: 303

Submitted to:

National Aeronautics and Space Administration
Goddard Space Flight Center
Greenbelt, Maryland 20771

Submitted by:

Aerojet
1100 West Hollyvale Street
Azusa, California 91702

Aerojet

Report 10427
March 1996
REV.A

Integrated AMSU-A
Earth Observing System (EOS)
Advanced Microwave Sounding Unit-A (AMSU-A)
Command List Description

Contract No: NAS 5-32314
CDRL: 303

Submitted to:

National Aeronautics and Space Administration
Goddard Space Flight Center
Greenbelt, Maryland 20771

Submitted by:

Aerojet
1100 West Hollyvale Street
Azusa, California 91702

TABLE OF CONTENTS

FIGURES

FIGURE

TABLE

TABLE

Section 1

SCOPE

1.0 This report contains a complete list of EOS/AMSU-A commands for all modes of operation and testing with a description of their effects. There are no EOS/AMSU-A critical commands; i.e., commands that could damage the instrument in any situation.

2.0 IN-ORBIT AMSU-A OPERATIONAL COMMANDS

AMSU-A1 and AMSU-A2 modules are controlled in orbit by commands. AMSU-A1 utilizes sixteen commands. AMSU-A2 utilizes twelve commands. Description of each command are as follows:

2.1 AMSU-A1 COMMANDS

2.1.1 DIRECT COMMANDS, PULSE DISCRETE

1) Antenna in Full Scan Mode. Full scan "ON" commands instrument into the normal operation scanning mode. When in full scan "OFF" is commanded and no other command is given, reflectors will complete scanning cycle and park at warm load.

2) Antenna in Warm Cal Mode. Commands the instrument reflectors to move to the warm calibration position and stop there.

3) Antenna in Cold Cal Mode. Commands the instrument reflectors to move to the cold calibration position selected by the Cold Calibration Position select command and stop there. There are four cold calibration positions.

4) Antenna in Nadir Mode. Commands the instrument reflectors to move to the nadir position (scene station 15) and stop there.

5) Antenna in No Mode. A state that exists when none of the above commands has been issued to the instrument. The instrument must be in this mode for the GSE scenarios to be invoked during ground test.

6) Cold Cal Position 1. Selects cold calibration position 1 (-96.6667^{o} relative to zenith).

7) Cold Cal Position 2. Selects cold calibration position (-98.333^{o} relative to zenith).

8) Cold Cal Position 3. Selects cold calibration position 3 (-99.999^{o} relative to zenith).

9) Cold Cal Position 4. Selects cold calibration position 4 (-103.332^{o} relative to zenith).

10) Scanner 1 Power On. Applies or removes 28 volt power from the Noisy Power Bus to the A1-1 scan drive output circuits thus controlling reflector scan operation.

11) Scanner 1 Power Off. Applies or removes 28 volt power from the Noisy Power Bus to the A1-1 scan drive output circuits thus controlling reflector scan operation.

12) Scanner 2 Power On. Applies or removes 28 volt power from the Noisy Power Bus to the A1-2 scan drive output circuits thus controlling reflector scan operation.

13) Scanner 2 Power Off. Applies or removes 28 volt power from the Noisy Power Bus to the A1-2 scan drive output circuits thus controlling reflector scan operation.

14) PLO Number 1. Energizes Phase Lock Loop Oscillator #1in the A1 instrument module.

15) PLO Number 2. Phase Lock Loop Oscillator #2 in the A1 instrument module.

16) Reset C&DH Processor.

2.2 AMSU-A2 COMMANDS

2.2.1 DIRECT COMMANDS, PULSE DISCRETE

1) Antenna in Full Scan Mode. Full scan "ON" commands instrument into the normal operation scanning mode. When in full scan "OFF" is commanded and no other command is given, reflectors will complete scanning cycle and park at warm load.

2) Antenna in Warm Cal Mode. Commands the instrument reflectors to move to the warm calibration position and stop there.

3) Antenna in Cold Cal Mode. Commands the instrument reflectors to move to the cold calibration position selected by the Cold Calibration Position select command and stop there. There are four cold calibration positions.

4) Antenna in Nadir Mode. Commands the instrument reflectors to move to the nadir position (scene station 15) and stop there.

5) Antenna in No Mode. A state that exists when none of the above commands has been issued to the instrument. The instrument must be in this mode for the GSE scenarios to be invoked during ground test.

6) Cold Cal Position 1. Selects cold calibration position 1 (-96.6667° relative to zenith).

7) Cold Cal Position 2. Selects cold calibration position (-98.333° relative to zenith).

8) Cold Cal Position 3. Selects cold calibration position 3 (-99.999° relative to zenith).

9) Cold Cal Position 4. Selects cold calibration position 4 (-103.332° relative to zenith).

10) Scanner Power On. Applies or removes 28 volt power from the Noisy Power Bus to the A2 scan drive output circuits thus controlling reflector scan operation.

11) Scanner Power Off. Applies or removes 28 volt power from the Noisy Power Bus to the A2 scan drive output circuits thus controlling reflector scan operation.

12) Reset C & DH Processor.

3.1 COMMAND SEQUENCES AMSU-A1

- Turns on Sequence

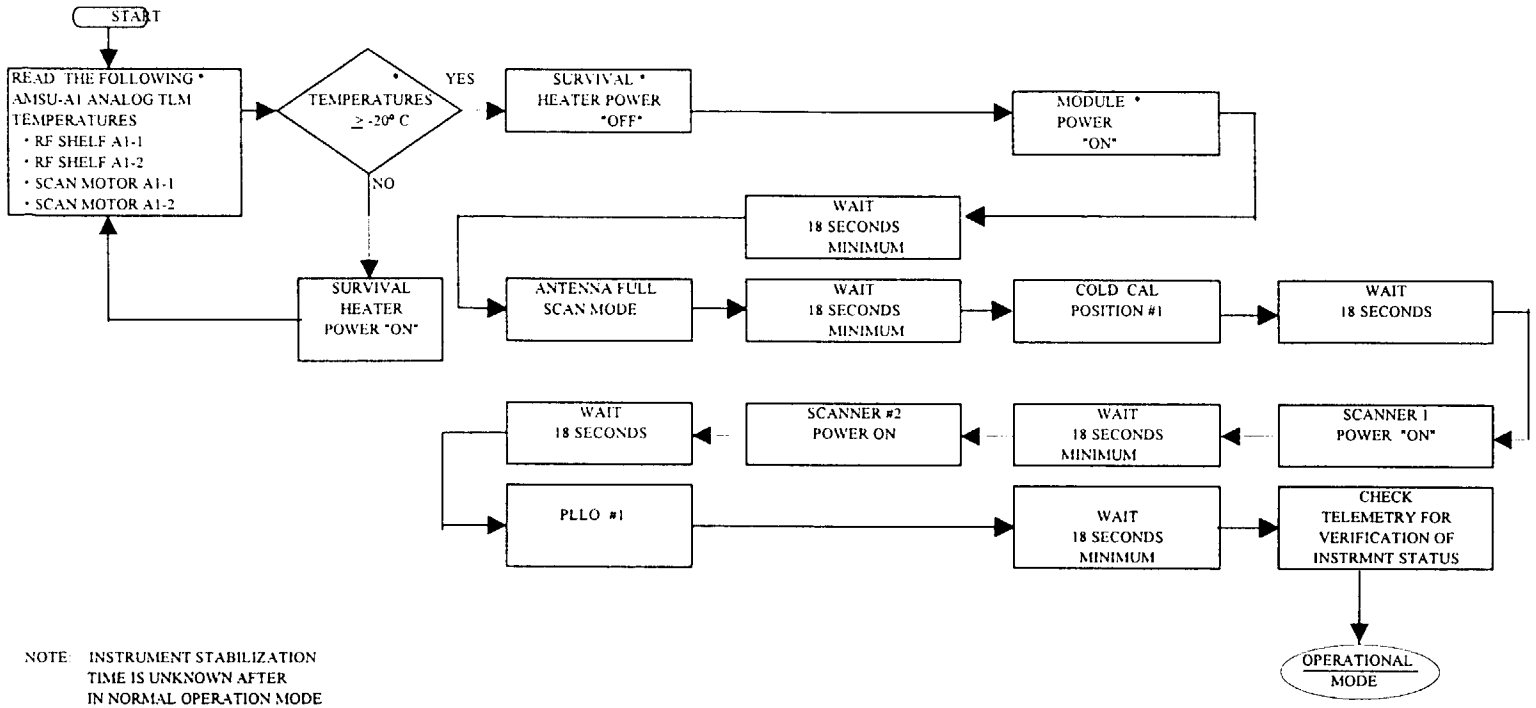
Prior to delivery from AESC, AMSU-A1 will be in the "OFF State" that means both of the antennas will be at the warm calibration position and power to both scanners will be in the off state. Initial turn on sequence on ground and in orbit shall be as shown in figure 1.

- "Turn OFF" Sequence as shown in Figure 2.

- "STANDBY Sequence" as shown in Figure 3.

- "EMERGENCY OFF" Sequences as shown in Figure 4.

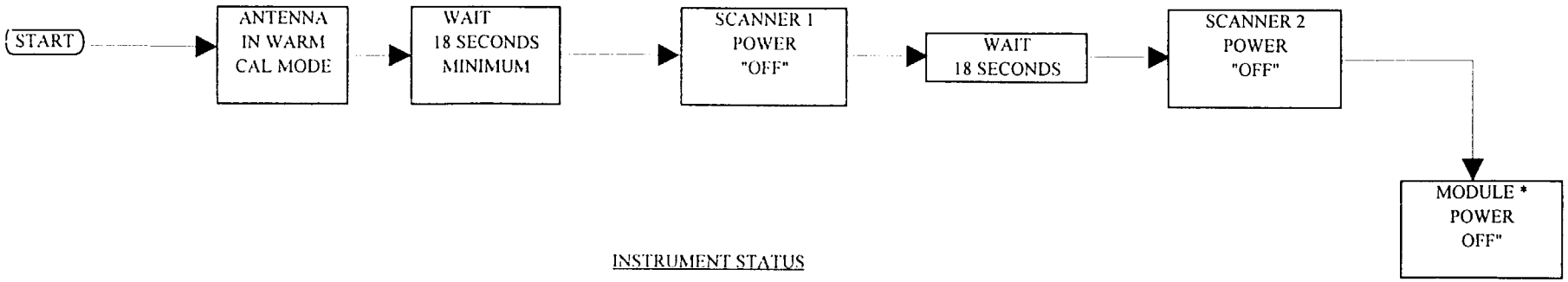
- "TURN ON" Sequence after EMERGENCY OFF as shown in Figure 5.



NOTE: INSTRUMENT STABILIZATION TIME IS UNKNOWN AFTER IN NORMAL OPERATION MODE

AMSU-A1 IN-ORBIT "TURN-ON" SEQUENCE

FIGURE - 1



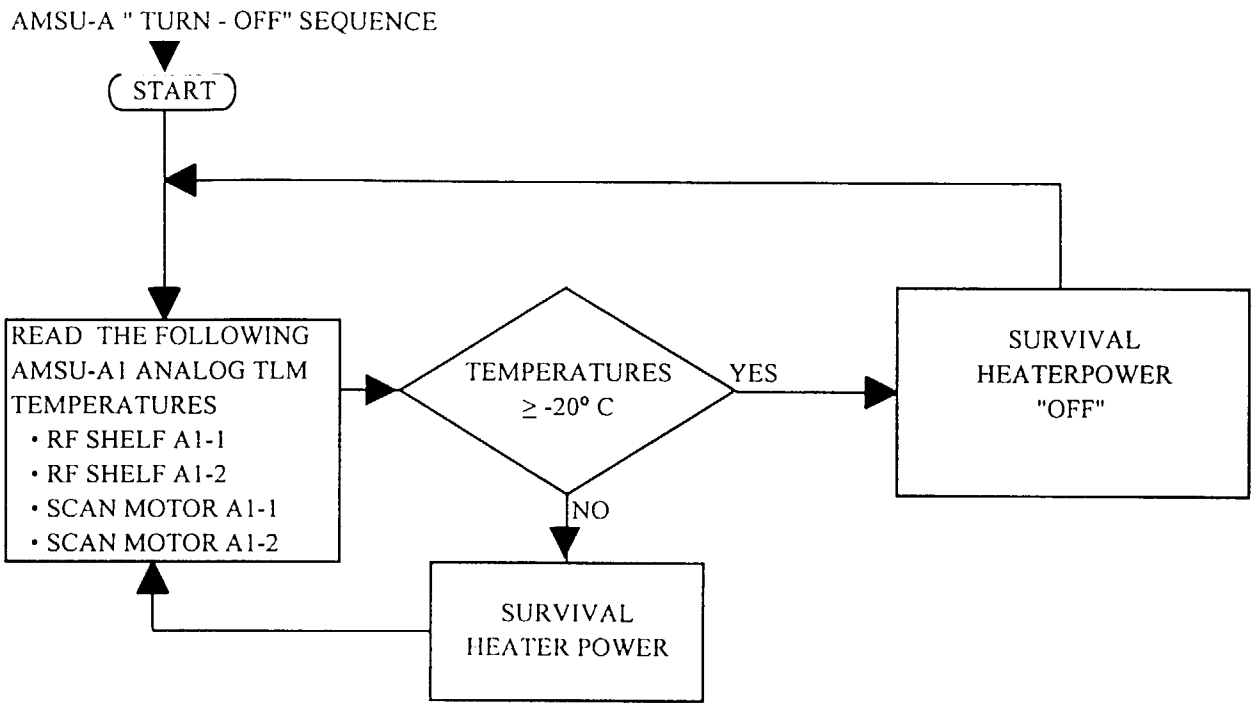
INSTRUMENT STATUS

- BOTH ANTENNA AT WARM CALIBRATION POSITION
- POWER TO BOTH SCANNERS IN OFF STATE

* SPACECRAFT SHALL EXECUTE THE ACTION

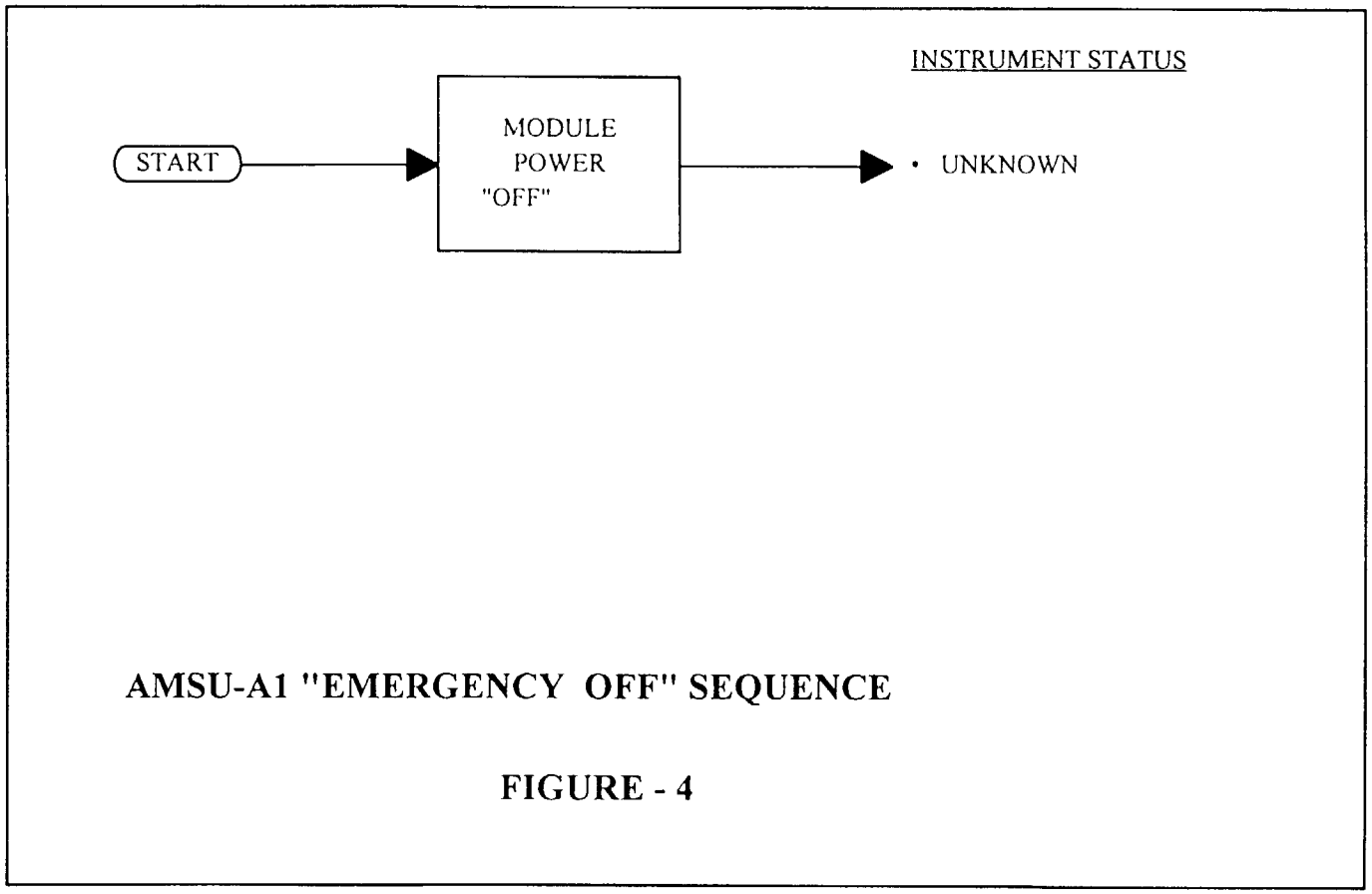
AMSU-A1 "TURN-OFF" SEQUENCE

FIGURE - 2



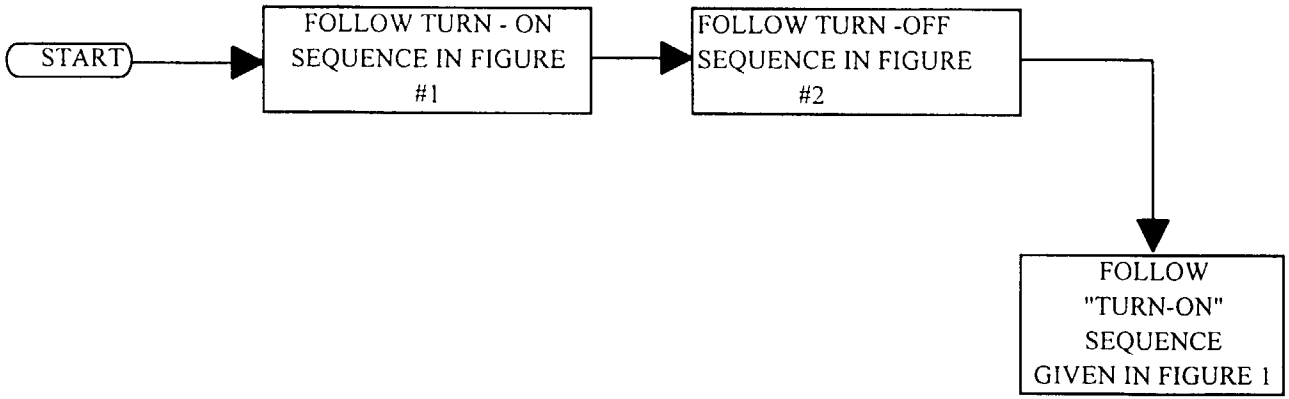
AMSU-A1 "STAND BY" (SAFE STATE) SEQUENCE
(AFTER AMSU-A1 "TURN OFF" SEQUENCE")

FIGURE - 3



AMSU-A1 "EMERGENCY OFF" SEQUENCE

FIGURE - 4



AMSU - A1 "TURN-ON" SEQUENCE AFTER EMERGENCY OFF

FIGURE - 5

- Secondary phase lock loop operation.

  Send PHASE LOCK LOOP POWER command to PLLO #2.

  If instrument is OFF then follow the normal turn-on sequence and instead of sending PHASE LOCK LOOP POWER command to PLLO #1, send PHASE LOCK LOOP POWER command to PLLO #2.

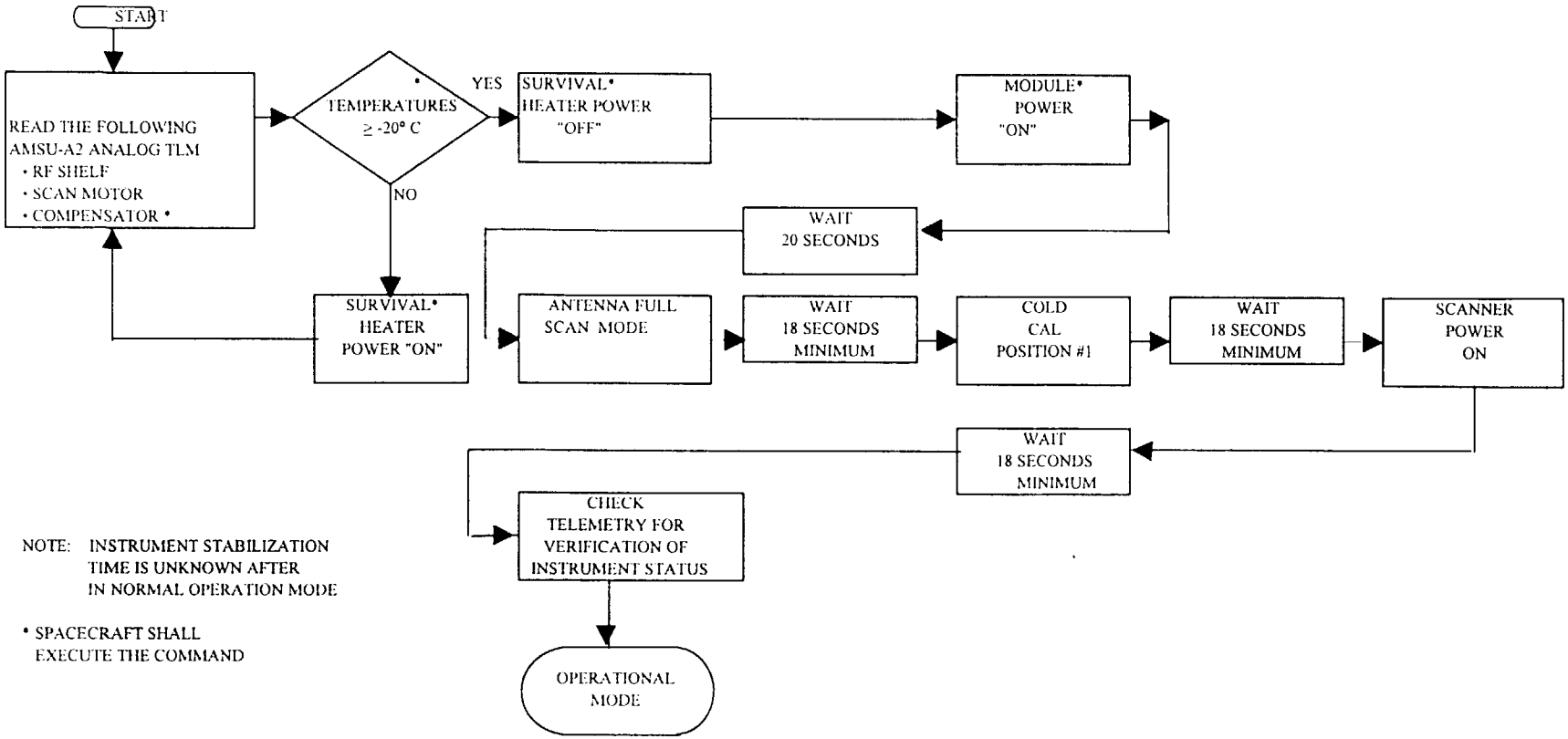
- Selection of cold cal position

Instrument is operating in normal mode. (There are four cold cal positions). During normal mode operation turn-on sequence, the primary cold calibration position is selected. To select any one of the 4 Cold Cal Mode, the following sequence must be executed.

1. Send COLD CAL command on ON.
2. Wait at least 18 seconds.
3. Send COLD CAL POSITION 1, 2, 3 or 4.
4. Wait at least 18 seconds.
5. Send FULL SCAN command to ON.

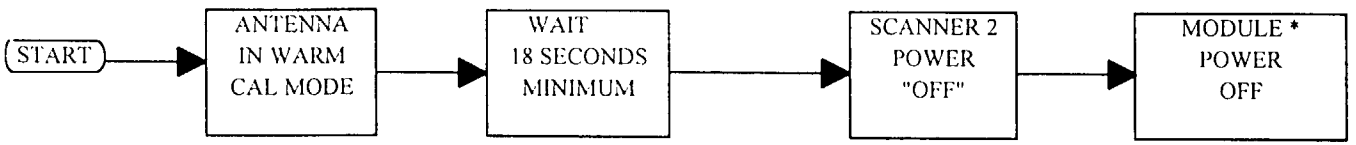
3.2 COMMAND SEQUENCES AMSU-A2

- "TURN ON" Sequence as shown in Figure 6.
- "TURN OFF" Sequence as shown in Figure 7
- "STANDBY" (SAFE STATE) Sequence similar to A1.
- "EMERGENCY OFF" Sequence similar to A1.
- "TURN ON" Sequence after EMERGENCY OFF similar to A1.
- Selection of Cold Cal positon similar to A1.



AMSU-A2 IN-ORBIT "TURN-ON" SEQUENCE

FIGURE - 6



INSTRUMENT STATUS

- ANTENNA AT WARM CALIBRATION POSITION
- POWER TO SCANNER IN "OFF" STATE

* SPACECRAFT SHALL EXECUTE THE ACTION

AMSU - A2 "TURN-ON" SEQUENCE AFTER EMERGENCY OFF

FIGURE - 7

4.0 SUMMARY OF OPERATION MODES

Table 1 and Table 2 provides summary of operation modes vs AMSU-A operation for AMSU-A1 and AMSU-A2 respectively.

5.0 GENERAL

The instrument has been designed such that an erroneous or out of sequence commands will not damage the instrument and will recover and operate normally after correct commands are issued.

5.1 INSTRUMENT COMMANDS

AMSU-A is designed to respond to commands with the following characteristics:

1. Commands are formatted in accordance with the CCSDS telecommand packet defined in CCSDS 203.0-3-1.
2. A single command packet is 64 octets or shorter, including headers, and its data field shall be an even number of octets.
3. No state-dependent or toggle commands are used.
4. Within commands that control a number of discrete conditions, each controlled function are an enabling/disabling bit.

5.2 COMMAND EXECTUION VERIFICATION

Command execution shall be verifiable via processor telemetry.

5.3 COMMAND SET

The AMSU A1 and A2 commands are shown in Tables 3 and 4 respectively. The Command/Status word is shown for A1 and A2 in Figures 8 and 9 respectively.

TABLE - 1 AMSU-A1 OPERATIONAL REQUIREMENTS

COMMANDS >>	SPACECRAFT		AMSU-A1 COMMANDS						
OPERATION MODES	MODULE POWER OFF/ON	SURVIVAL HEATER OFF/ON	SCANNER A1-1 ON/OFF	SCANNER A1-2 ON/OFF	ANTENNA AT WARM CAL. POS.	ANTENNA AT COLD CAL. POS.1 2 3 4	ANTENNA AT NADIR POS.	FULL SCAN	PHASE LOCK LOOP SELECT PLLO1 / PLLO2
PRIOR TO LAUNCH/ DELIVERY	N/A	N/A	OFF	OFF	YES				
STANDBY OR BEFORE OPERATION (IN-ORBIT)	OFF	ON	OFF	OFF	YES				
AT TIME OF OPERATION (IN-ORBIT)	ON	OFF	OFF	OFF	YES				
NORMAL (IN-ORBIT) OPERATION	ON	OFF	ON	ON	NO	NO	NO	YES @	PLLO#1
NORMAL (IN-ORBIT) OPERATION WITH REDUNDANT PLL LO	ON	OFF	ON	ON	NO	NO	NO	YES	PLLO #2
UNIQUE OPERATION (IN ORBIT)									
SCANNER A1-1 OFF	ON	OFF	OFF	ON	**	**	**	**	
SCANNER A1-2 OFF	ON	OFF	ON	OFF	***	***	***	***	
WARM CAL. POS.	ON	OFF	ON	ON	YES			NO	
COLD CAL. POS. 1,2,3 & 4	ON	OFF	ON	ON	NO	ON		NO	
• NADIR POS.			ON	ON	OFF	OFF	ON	OFF	
EMERGENCY OFF	OFF	OFF							

* TURN ON SURVIVAL HEATER IF AMSU-A1 MODULE TEMPERATURES (RF SHELVES AND/OR SCANNER MOTORS) ARE BELOW -20C.

** A1-1 SCANNER WILL BE AT WARM CAL. A1-2 SCANNER WILL FOLLOW ONE OF THE FOUR SCAN COMMANDS (FULL SCAN OR WARM CAL. OR COLD CAL. OR NADIR POS. (PRIORITY BETWEEN THE FOUR COMMANDS ARE: 1st FULL SCAN, 2nd WARM CAL., 3rd COLD CAL., 4th NADIR POS.)

*** A1-2 SCANNER WILL BE AT WARM CAL. A1-1 SCANNER WILL FOLLOW ONE OF THE FOUR SCAN COMMANDS ACCORDING TO PRIORITY

NOTE: @ DURING FULL SCAN "IN-ORBIT" MODE ANTENNAS WIL BE VIEWING PRIMARY COLD CALIBRATION POSITION.

TABLE - 2 AMSU-A2 OPERATIONAL REQUIREMENTS

COMMANDS →	PROVIDED BY SPACECRAFT		AMSU-A2 COMMANDS				
OPERATION MODES	MODULE POWER OFF/ON	SURVIVAL HEATER OFF/ON	SCANNER A2 0N/OFF	ANTENNA AT WARM CAL. POS.	ANTENNA AT COLD CAL. POS.	ANTENNA AT NADIR POS.	FULL SCAN
PRIOR TO LAUNCH/ DELIVERY	N/A	N/A	OFF	YES			
STANDBY OR BEFORE OPERATION (IN-ORBIT)	OFF	ON	OFF	YES			
AT TIME OF OPERATION (IN-ORBIT)	ON	OFF	ON				
NORMAL (IN-ORBIT) OPERATION	ON	OFF	ON				YES @
UNIQUE OPERATION *** (IN-ORBIT)							
• SCANNER A2 OFF	ON	OFF	OFF	YES			
• WARM CAL. POS.	ON		ON	YES			NO
• COLD CAL. POS. 1,2,3&4	ON		ON	NO	YES		NO
• NADIR POS.	ON		ON	NO	NO	YES	NO
EMERGENCY OFF	OFF	OFF					

* TURN ON SURVIVAL HEATER IF AMSU-A2 MODULE TEMPERATURES (RF SHELF AND/OR MOTORS) ARE BELOW -20° C.

*** THE A2 SCANNER MOTOR WILL FOLLOW ONE OF THE FOUR SCAN COMMANDS ACCORDING TO PRIORITY. (PRIORITY BETWEEN THE FOUR COMMANDS ARE : 1st · FULL SCAN, 2nd · WARM CAL., 3rd · COLD CAL., 4th · NADIR POS.).

@ DURING FULL SCAN "IN-ORBIT" MODE ANTENNAS WILL BE VIEWING PRIMARY COLD CALIBRATION POSITION.

Table 3. EOS / AMSU-A1 Commands

Commands	Command Word	Mask Word
1. Antenna in Full Scan Mode	2	65505
2. Antenna in Warm Cal Mode	4	65505
3. Antenna in Cold Cal Mode	8	65505
4. Antenna in Nadir Mode	16	65505
5. Antenna in No Mode	0	65505
6. Cold Cal Position 1	0	65439
7. Cold Cal Position 2	32	65439
8. Cold Cal Position 3	64	65439
9. Cold Cal Position 4	96	65439
10. Scanner 1 Power On	2048	63487
11. Scanner 1 Power Off	0	63487
12. Scanner 2 Power On	4096	61439
13. Scanner 2 Power Off	0	61439
14. PLO Number 1	512	65023
15. PLO Number 2	0	65023
16. Reset C&DH Processor	256	65279

Table 4. EOS / AMSU-A2 Commands

Commands	Command Word	Mask Word
1. Antenna in Full Scan Mode	2	65505
2. Antenna in Warm Cal Mode	4	65505
3. Antenna in Cold Cal Mode	8	65505
4. Antenna in Nadir Mode	16	65505
5. Antenna in No Mode	0	65505
6. Cold Cal. Position #1	0	65439
7 Cold Cal. Position #2	32	65439
8. Cold Cal Position 3	64	65439
9. Cold Cal Position 4	96	65439
10. Scanner Power On	2048	63487
11. Scanner Power Off	0	63487
12. Reset C&DH Processor	256	65279

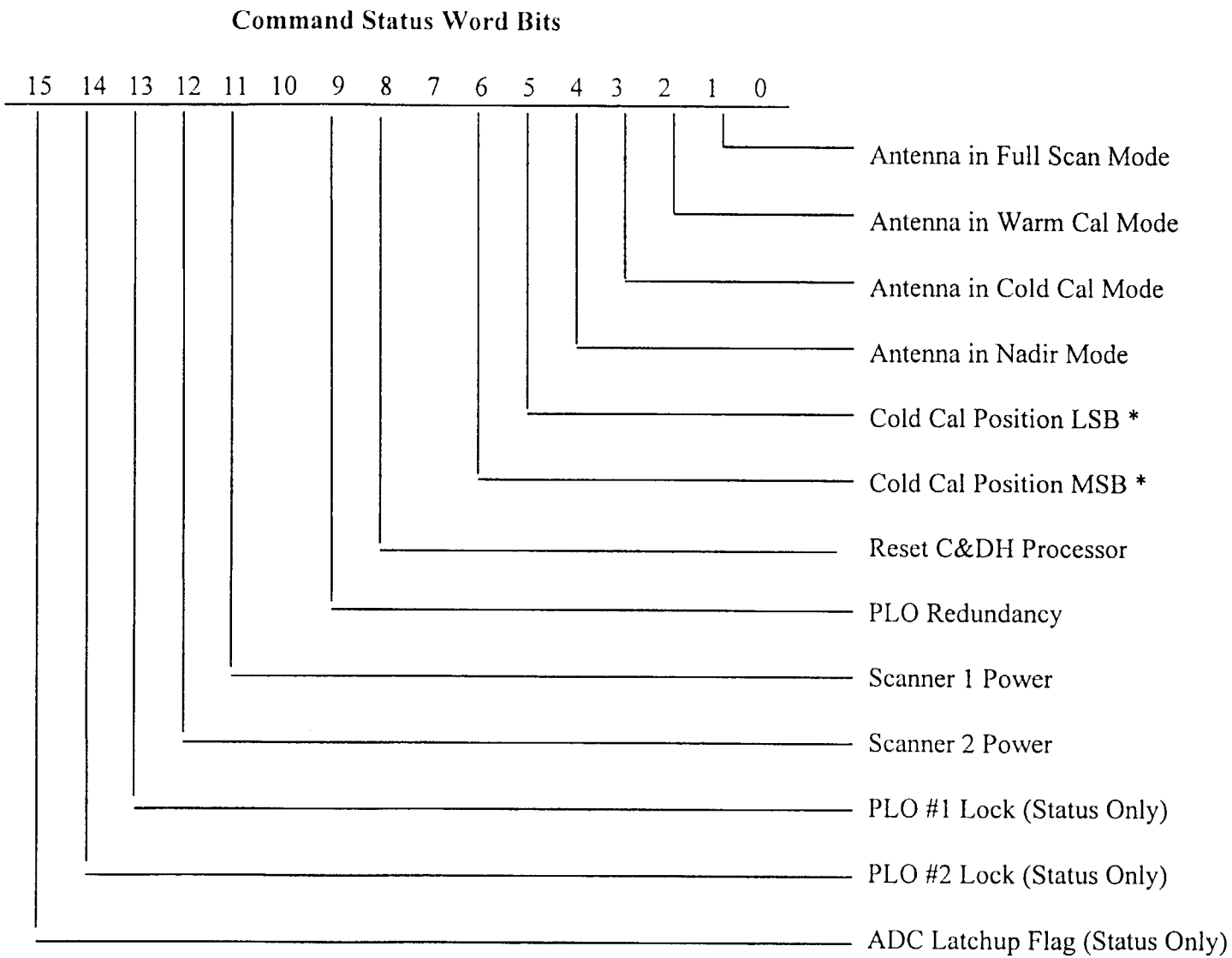


Figure 8. EOS / AMSU - A1 Command / Status

* Cold Cal.	MSB	LSB
1	0	0
2	0	1
3	1	0
4	1	1

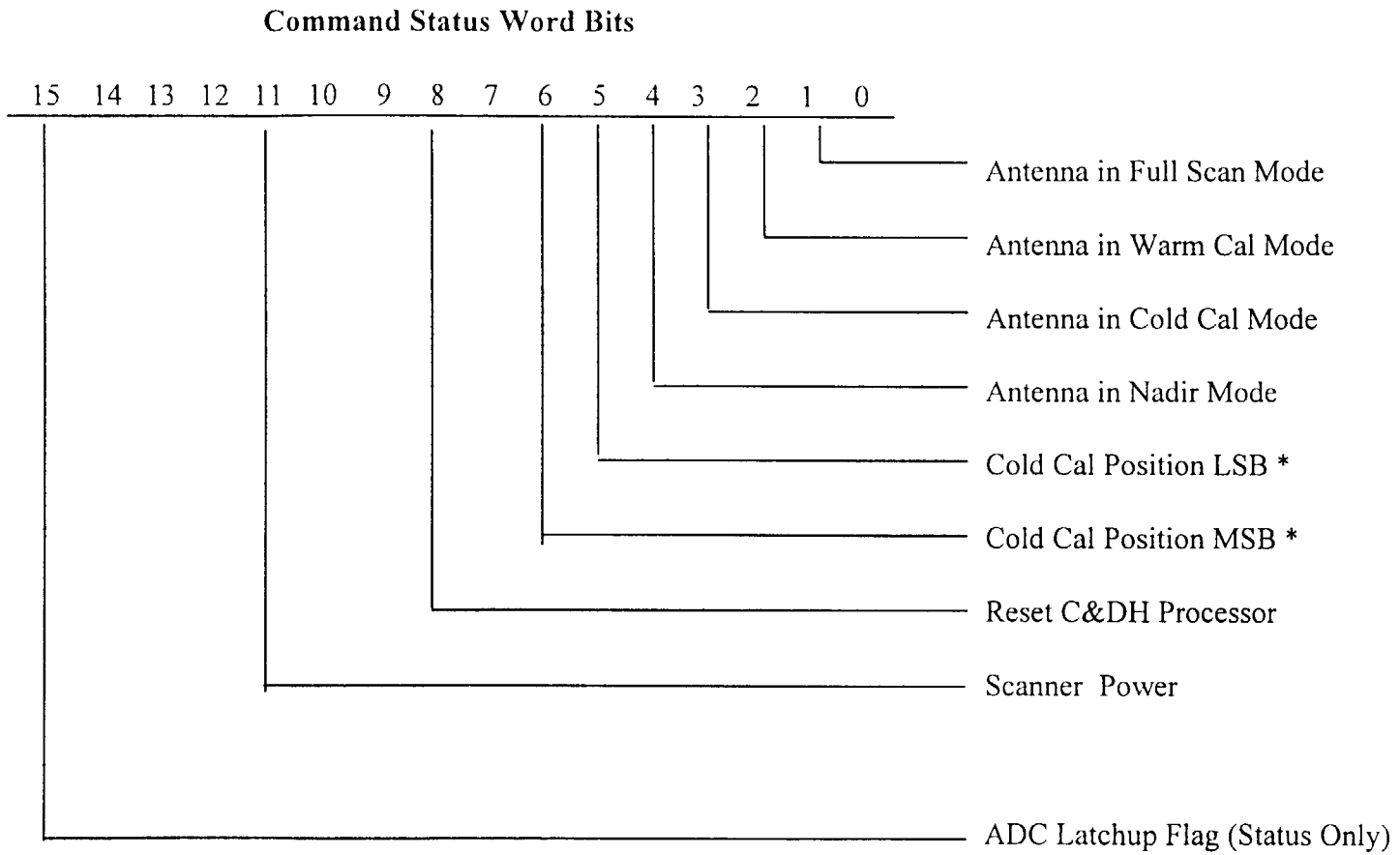


Figure 9. EOS / AMSU - A2 Command / Status

* COLD CAL. POS.	MSB	LSB
1	0	0
2	0	1
3	1	0
4	1	1

6.0 GSE SCENARIOS

The GSE scenarios shown in Table 5 are used exclusively for ground test and calibration purposes and are included in this document for completeness. Before any GSE scenario can be selected, the instrument must be in the No Mode State. Note: There is no GSE scenario 6. The GSE scenario can be selected via the test connector only.

Table 5 GSE Scenarios

GSE Scenario No.	Description
1	The reflectors slew directly to scene station 6, then cold calibration, then warm calibration, pausing at each. The action is repeated until the command is revoked.
2	The reflectors slew directly to scene station 1, moving in either direction of rotation, depending on which provides the shortest path. The reflectors remain at scene station 1 until commanded elsewhere.
3	The reflectors step through all thirty scene stations plus the two calibration positions, remaining at each for 8 seconds. The instrument will repeat this cycle until the command is revoked.
4	The reflectors slew directly to scene station 30, moving in either direction of rotation, depending on which provides the shortest path. The reflectors remain at scene station 30 until commanded elsewhere.
5	The reflectors slew directly to scene station 6, moving in either direction of rotation, depending on which provides the shortest path. The reflectors remain at scene station 6 until commanded elsewhere.
7	This is used in conjunction with GSE Scenario 3 and will pause the reflectors at whatever position they happen to be in.
0	This command disables the GSE scenario mode and allows the instrument to return to normal operation.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (*Leave blank*)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED

4. TITLE AND SUBTITLE
Integrated Advanced Microwave Sounding Unit -A (AMSU-A), Command List and Description

5. FUNDING NUMBERS
NAS 5-32314

6. AUTHOR(S)
R.V. Hauerwaas

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Aerojet
1100 W. Hollyvale
Azusa, CA 91702

8. PERFORMING ORGANIZATION REPORT NUMBER
CDRL 303
10427A
March 1966

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
NASA
Goddard Space Flight Center
Greenbelt, Maryland 20771

10. SPONSORING/MONITORING AGENCY REPORT NUMBER
---

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT

12b. DISTRIBUTION CODE
---

13. ABSTRACT (*Maximum 200 words*)

This is the Command List and Description for the Integrated Advanced Microwave Sounding Unit-A (AMSU-A).

14. SUBJECT TERMS
EOS
Microwave System

15. NUMBER OF PAGES
32

16. PRICE CODE
---

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	SAR

GENERAL INSTRUCTIONS FOR COMPLETING SF 298

The Report Documentation Page (RDP) is used in announcing and cataloging reports. It is important that this information be consistent with the rest of the report, particularly the cover and title page. Instructions for filing in each block of the form follow. It is important to stay within the lines to meet optical scanning requirements.

Block 1. Agency Use Only *(Leave blank)*

Block 2. Report Date. Full publication date including day, month, and year, if available (e.g., 1 Jan 88). Must cite at least the year.

Block 3. Type of Report and Dates Covered. State whether report is interim, final, etc. If applicable, enter inclusive report dates (e.g., 10 Jun 87 - 30 Jun 88).

Block 4. Title and Subtitle. A title is taken from the part of the report that provides the most meaningful and complete information. When a report is prepared in more than one volume, report the primary title, add volume number, and include subtitle for the specific volume. On classified documents enter the title classification in parentheses.

Block 5. Funding Numbers. To include contract and grant numbers; may include program element number(s), project number(s), tasks number(s), and work unit number(s). Use the following labels:

C	-	Contract	PR	-	Project
G	-	Grant	TA	-	Task
PE	-	Program Element	WU	-	Work Unit Accession No.

Block 6. Author(s). Name(s) of person(s) responsible for writing the report, performing the research, or credited with the content of the report. If editor or compiler, this should follow the name(s).

Block 7. Performing Organization Name(s) and Address(es). Self-explanatory.

Block 8. Performing Organization Report Number. Enter the unique alphanumeric report number(s) assigned by the organization performing the report.

Block 9. Sponsoring/Monitoring Agency Name(s) and Address(es) Self-explanatory.

Block 10. Sponsoring/Monitoring Agency Reports Number. (*if known*).

Block 11. Supplementary Notes. Enter information not included elsewhere such as: Prepared in cooperation with ...; Trans. of ...; To be published in ... When a report is revised, include a statement whether the new report supersedes or supplements the older report.

Block 12.a Distribution/Availability Statement. Denotes public availability or limitations. Cite any availability to the public. Enter additional limitations or special markings in all capitals (e.g., NOFORN, REL, ITAR).

DOD - See DoDD 5230.24 "*Distribution Statement on Technical Documents*
DOE - See authorities.
NASA - See Handbook NHB 2200.2.
NTIS - Leave blank.

Block 12.b Distribution Code.

DOD - Leave blank.
DOE - Enter DOE distribution categories from the standard Distribution for Unclassified Scientific and Technical Reports.
NASA - Leave blank.
NTIS - Leave blank.

Block 13. Abstract. Include a brief (*Maximum 200 words*) factual summary of the most significant information contained in the report.

Block 14. Subject Terms. Keywords or phases identifying major subjects in the report.

Block 15. Number of Pages. Enter the total number of pages.

Block 16. Price Code. Enter appropriate price code (*NTIS only*).

Block 17 - 19. Security Classifications. Self-explanatory. Enter U.S. Security Classification in accordance with U.S. Security Regulations (i.e., UNCLASSIFIED). If form contains classified information, stamp classification on the top and bottom of the page.

Block 20. Limitation of Abstract. This block must be completed to assign a limitation to the abstract. Enter either UL (unlimited) or SAR (same as report). An entry in this block is necessary if the abstract is to be limited. If blank, the abstract is assumed to be unlimited.

Standard Form 298 Back (Rev. 2-89)

NASA
National Aeronautics and Space Administration

Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
---	---	---

4. Title and Subtitle	5. Report Date
Integrated Advanced Microwave Sounding Unit-A (AMSU-A), Command List and Description	March 1996
	6. Performing Organization Code: ---
7. Author(s): R.V. Haurewaas	8. Performing Organization Report No.: 10427A
	10. Work Unit No.: ---
9. Performing Organization Name and Address: Aerojet, 1100 W. Hollyvale, Azusa, CA 91702	11. Contract or Grant No.: NAS 5-32314
12. Sponsoring Agency Name and Address: NASA, Goddard Space Flight Center, Greenbelt, Maryland 20771	13. Type of Report and Period Covered: Final
	14. Sponsoring Agency Code: ---

15. Supplementary Notes

---

16. ABSTRACT (*Maximum 200 words*)

This is the Command List and Description for the Integrated Advanced Microwave Sounding Unit-A (AMSU-A)

17. Key Words (Suggested by Author(s))	18. Distribution Statement
EOS Microwave System	Unclassified --- Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of pages	22. Price
Unclassified	Unclassified	65	---

NASA FORM 1626 OCT 86

PREPARATION OF THE REPORT DOCUMENTATION PAGE

The last page of a report facing the third cover is the Report Documentation Page, RDP. Information presented on this page is used in announcing and cataloging reports as well as preparing the cover and title page. Thus, it is important that the information be correct. Instructions for filing in each block of the form are as follows:

Block 1. Report No. NASA report series number, if preassigned.

Block 2. Government Accession No. Leave blank.

Block 3. Recipient's Catalog No.. Reserved for use by each report recipient.

Block 4. Title and Subtitle. Typed in caps and lower case with dash or period separating subtitle from title.

Block 5. Report Date. Approximate month and year the report will be published.

Block 6. Performing Organization Code. Leave blank.

Block 7. Authors. Provide full names exactly as they are to appear on the title page. If applicable, the word editor should follow a name.

Block 8. Performing Organization Report No. NASA installation report control number and, if desired, the non-NASA performing organization report control number.

Block 9. Performing Organization Name and Address. Provide affiliation (NASA program office, NASA installation, or contractor name) of authors.

Block 10. Work Unit No. Provide Research and Technology Objectives and Plants (RTOP) number.

Block 11. Contract or Grant No. Provide when applicable.

Block 12. Sponsoring Agency Name and Address. National Aeronautics and Space Administration, Washington, D.C. 20546-0001. If contractor report, add NASA installation or HQ program office.

Block 13. Type of Report and Period Covered. NASA formal report series; for Contractor Report also list type (interim, final) and period covered when applicable.

Block 14. Sponsoring Agency Code. Leave blank.

Block 15. Supplementary Notes. Information not included elsewhere: affiliation of authors if additional space is required for Block 9, notice of work sponsored by another agency, monitor of contract, information about supplements (file, data tapes, etc.) meeting site and date for presented papers, journal to which an article has been submitted, note of a report made from a thesis, appendix by author other than shown in Block 7.

Block 16. Abstract. The abstract should be informative rather than descriptive and should state the objectives of the investigation, the methods employed (e.g., simulation, experiment, or remote sensing), the results obtained, and the conclusions reached.

Block 17. Key Words. Identifying words or phrases to be used in cataloging the report.

Block 18. Distribution Statement. Indicate whether report is available to public or not. If not to be controlled, use "Unclassified-Unlimited." If controlled availability is required, list the category approved on the Document Availability Authorization Form (see NHB 2200.2, Form FF427). Also specify subject category (see "Table of Contents" in a current issue of STAR) in which report is to be distributed.

Block 19. Security Classification (of the report). Self-explanatory.

Block 20. Security Classification (of this page). Self-explanatory.

Block 21. No. of Pages. Count front matter pages beginning with iii, text pages including internal blank pages, and the RDP, but not the title page or the back of the title page.

Block 22. Price Code. If Block 18 shows "Unclassified-Unlimited," provide the NTIS price code (see "NTIS Price Schedules" in a current issue of STAR) and at the bottom of the form add either "For sale by the National Technical Information Service, Springfield, VA 22161-2171" or "For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402-0001," whichever is appropriate.